**Testimony of**
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**Resources Committee**
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## INTRODUCTORY COMMENTS

Good morning, Mr. Chairman and members of the Subcommittee. My name is Richard W. Spinrad, Ph.D., Assistant Administrator of NOAA for Ocean Services and Coastal Zone Management. In this capacity, I administer the programs within NOAA's National Ocean Service. This includes programs addressing ecosystem research, navigation, coastal zone management, marine sanctuaries, and response and restoration. This also includes the science programs of the National Centers for Coastal Ocean Science, which implements the Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (HABHRCA or the Act). I appreciate the opportunity to discuss the reauthorization of the Act and NOAA's role in the national response to harmful algal blooms and hypoxia in our coastal waters and the Great Lakes.

Harmful Algal Blooms or HABs occur in the waters of nearly every coastal and Great Lakes State and our international neighbors. It is estimated that HABs have been responsible for an estimated $1 billion in economic losses over the past few decades. These blooms have decimated the scallop fishery in Long Island's estuaries and have led to seasonal closures of similar fisheries from Georges Bank to North Carolina and in the Gulf of Mexico and the Pacific Coast, including Hawaii and Alaska. They have contributed to the deaths of hundreds of manatees in Florida, sea lions in California, and whales in the Gulf of Maine and on Georges Bank. And, of course, Mr. Chairman I know you are aware of the recent impacts that harmful algal blooms and hypoxia events in the Chesapeake Bay have had on the lives and economies of area communities. Certain HABs have caused respiratory and other illness in coastal residents and vacationers and, in some cases, deaths and serious illnesses from toxins accumulated in shellfish. There are several causes of harmful algal blooms and hypoxia. Some are natural, but others are human-induced, and on-going research continues to identify and distinguish these causes.

Excess nutrient loads can be responsible for the overgrowth of algae in many coastal ecosystems. Not all algae are toxic; the death and subsequent decay of massive non-toxic blooms can lead to severe oxygen depletion (e.g., oxygen levels low enough to cause

significant ecological impairment) in the bottom waters of estuaries and coastal environments. Perhaps the most widely known example is the enormous hypoxic area or "dead zone" off the coasts of Louisiana and Texas. NOAA's recent National Eutrophication Assessment has revealed that, at some time each year, over half of our Nation's estuaries experience natural-caused and/or human-induced hypoxic conditions. Thirty percent experience anoxia (e.g., areas where all of the oxygen is absent) resulting in fish kills and other resource impacts. Harmful algal blooms and hypoxia are now among the most pressing environmental issues facing some coastal states.

**COMMENTS ON H.R. 1856**

In general, the Administration supports the purposes of HABHRCA and this bill. This legislation builds on the many successes of the original Act, which I will highlight later in my testimony. Last year, the Administration submitted a views letter supporting the legislation. My comments on H.R. 1856 reflect the views expressed in that letter. The Administration has no objection to passage of this legislation, but urges Congress to amend the bill consistent with recommendations included in the letter, and consistent with the President's FY 2005 budget request.

Soon this Subcommittee and the Nation will have an opportunity to review the report of the U.S. Commission on Ocean Policy. In passing the Oceans Act of 2000, which created the Commission, one of Congress's overriding mandates was for the Commission to make recommendations for an integrated and coordinated national ocean policy. I would suggest that the interagency task force and partnerships created under HABHRCA, which bring together experts from across government and academia to address HABs and hypoxia, are an excellent example of coordinating efforts in the context of a specific societal concern. The Administration supports the amendment in this legislation that would preserve and sustain the interagency task force.

Recently, the United States and Mexico have been developing a Red Tide Monitoring Network in the Gulf of Mexico. Red tides in the Gulf of Mexico can cost $25 million or more for each major event. In 2002, a broad State, Federal and local partnership between NOAA, Navy, EPA, NASA, and coastal research laboratories formed to initiate development of an early warning and tacking observation system, known as the Hazardous Algal Blooms Observing System Pilot (HABSOS). The HABSOS pilot system has become an integral component of the developing designs for the Gulf Coastal Ocean Observing System (GCOOS) framework, which is part of the larger effort to develop an Integrated Ocean Observing System for the United States. To ultimately achieve an operational HAB forecasting system, essential HAB-related data must be collected from multiple sources and platforms across the region, and these data must be integrated, processed, and analyzed, and then communicated in a timely manner to resource and public health managers throughout the region.

The Administration also supports the language in H.R. 1856 that would extend the Act's scope to include the Great Lakes. Recent Great Lakes HAB outbreaks and the return of hypoxic conditions, especially in Lake Erie, serve as a reminder that these inland,

freshwater "seas" face challenges similar to those we are experiencing along our saltwater coasts and in our bays and estuaries. The Administration has ongoing HAB and hypoxia research in other coastal regions and plans to expand these investments around the Nation's coast.

The legislation would require the Task Force to issue updates of the National Scientific Assessment of saltwater and freshwater HABs every five years. Based on the assessment, the Task Force would be required to develop a National Research Plan for the prevention, control and mitigation of HABs and their impacts. Similarly, the legislation would require a National Scientific Assessment of hypoxia every five years. However, the bill does not include specific provisions requiring the development of a National Research Plan for prevention, control and mitigation of hypoxia. Language in the bill could be construed to require, or at least allow, development of such a plan, but it is unclear why the hypoxia provisions do not mirror the HAB provisions requirement for a National Research Plan. The Administration would support adding a section requiring the development of a Hypoxia National Research Plan.

The Administration had several other minor comments in its views letter and I have submitted a copy of that letter for the record. One recommendation is to remove the word "Federal" from provisions requiring the Task Force to evaluate the progress of HAB and hypoxia research programs. The goal here is to clarify that this is a national, not solely a Federal, effort and therefore the Task Force should be authorized to evaluate all related research programs. Another recommendation is to include a provision that would require the Task Force to review existing research plans as it develops its own plans. This is simply to avoid duplication and ensure that the Task Force is building on existing efforts. Another recommendation is to make sure that NOAA has broad and flexible authority to enter into various agreements, grants, and contracts in implementing the Act. This is to ensure that the goal of the Act, to forge the partnerships necessary to create a truly national effort, is met. The Administration also supports amendments to section 605, paragraphs 2 through 5, making explicit that the funds appropriated in this section are awarded through a competitive, peer reviewed program, such as the Coastal Ocean Program.

Finally, I would like to respond to a criticism of HABHRCA and this legislation. Some have claimed that, while HABHRCA requires assessments and research plans, it does not directly support implementation of the plans. At its heart, HABHRCA is a research act and the Task Force it creates is primarily made up of agency researchers and scientists with specific expertise regarding HABs and hypoxia. The Act does authorize ongoing research, including efforts that would implement the Task Force's research and monitoring recommendations. The Act also provides the Task Force with the authority to develop more policy-oriented recommendations, which it has done. This helps ensure decisions are based on the best available science. How or whether the policy recommendations of the Task Force are implemented is beyond its intended scope.

## IMPLEMENTATION OF HABHRCA

The Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 called for development of three scientific assessments and an action plan. HABHRCA also authorized a suite of scientific programs to help support efforts to prevent, control, and mitigate the impacts of HABs and hypoxia. NOAA and our Federal, state, and academic partners have made considerable progress in the scientific understanding, detection, monitoring, assessment, and prediction of HABs and hypoxia in coastal ecosystems. These advances are helping coastal managers undertake short- and long-term efforts to prevent and mitigate the detrimental effects of these phenomena on human health and on valuable coastal resources. My remarks outlining these accomplishments are organized around the key sections of the original Public Law.

Sec 604(a) - Assessment of Northern Gulf of Mexico Hypoxia

The National Science and Technical Council, through the Inter-Agency Task Force on Harmful Algal Blooms and Hypoxia, delivered the report, "Integrated Assessment of Hypoxia in the Northern Gulf of Mexico," to the Congress in May 2000. The assessment examined the distribution, dynamics, and causes of Gulf hypoxia; its ecological and economic consequences; the sources and loads of nutrients transported by the Mississippi River system to the Gulf of Mexico; the effects of reducing nutrient loads; methods for reducing nutrient loads; and social and economic costs and benefits of such methods. This integrated assessment provided the scientific underpinning for the subsequent Action Plan to reduce the size of the Gulf of Mexico hypoxic zone.

Sec 604(b) - Plan to Reduce, Mitigate, and Control Gulf Hypoxia.

The Action Plan was delivered to the Congress in January 2001 by the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, which is composed of eight Federal agencies, nine Mississippi Basin States, and two Indian Tribes. The Action Plan was based on the Integrated Assessment required by this statute, as well as other scientific and public input and consultations required by the law, gathered through seven public meetings. In balancing the environmental, social, and economic needs of this enormous watershed, the Plan established three goals:

- Coastal Goal - By the year 2015, reduce the 5-year running average extent of the Gulf of Mexico hypoxic zone to less than 5,000 square kilometers.
- Basin Goal - Restore and protect the waters of the 31 States and Tribal lands within the Mississippi/Atchafalaya River Basin.
- Quality of Life Goal - To improve the communities and economic conditions across the Mississippi/Atchafalaya River Basin.

To connect the environmental goal for the Gulf of Mexico to actions within the basin, the Action Plan also recognized the need to reduce nitrogen loads by at least 30 percent. This Watershed Nutrient Task Force is currently creating sub-basin committees that are to be led by states and will be tasked with developing implementation strategies. This approach was chosen by the Task Force with input from the States to best meet local needs. The Action Plan highlights that there are a variety of options available to meet the

overall goal and each has associated costs and benefits that vary by locale. The Task Force has also drafted a Monitoring, Modeling, and Research Strategy to ensure that actions taken over the next decade to reduce hypoxia are guided by the best science.

Sec 603(b) - National Assessment of Coastal Harmful Algal Blooms

The National Science and Technical Council, through its Inter-Agency Task Force on Harmful Algal Blooms and Hypoxia, produced the report, "National Assessment of Harmful Algal Blooms in U.S. Waters." The assessment, delivered to the Congress in February 2001, examines the ecological and economic consequences of harmful algal blooms, alternatives for reducing, mitigating, and controlling harmful algal blooms, and the social and economic costs and benefits of such alternatives. Highlights from the assessment include:

- HABs threaten human health and marine mammals, contaminate local fish and shellfish, and depress coastal tourist and recreational industries.
- There are more toxic species detected, more events, and more areas affected than 25 years ago.
- Natural events (e.g., storms and ocean currents), as well as human activities (e.g., excess nutrient loads), appear to contribute to HAB formation.
- Management options are limited at this time, with the focus on diligent monitoring. Recent advances in both molecular and remote-sensing detection methods are promising.
- It may be possible to prevent some HABs by controlling nutrient inputs, or to control blooms with clays or viruses which would precipitate or attack (respectively) the algal cells. More research is needed to determine the effectiveness and the potential environmental impacts of these methods.

While the analyses in this report have helped shape subsequent investments in our research and monitoring programs, there is still much to do.

Sec 603(c) - National Assessment of Coastal Hypoxia

The Inter-Agency Task Force on Harmful Algal Blooms and Hypoxia delayed development of this assessment to take advantage of the findings and recommendations of the Gulf of Mexico Integrated Assessment outlined above, the NOAA National Eutrophication Assessment, and the National Research Council report, *Clean Coastal Waters*. With those studies now complete, the Task Force has drafted the assessment, which outlines status and trends in coastal hypoxia. The draft assessment includes the causes and consequences of hypoxia, methods available to reduce hypoxic events, and a call for more scientific research to aid in future assessments. The report has been prepared and will be submitted to Congress upon final approval.

**Other Authorized Research Activities**

The Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 provided authority for NOAA to address the eight objectives outlined in the 1993 National Plan for Marine Biotoxins and Harmful Algae. The Act also extends NOAA's efforts related to

Gulf hypoxia. Most of the efforts authorized by this Act are implemented by NOAA through competitive, peer-reviewed grants, to engage the best scientists to focus on these important issues.

In our laboratories and through the Ecology and Oceanography of Harmful Algal Blooms program (ECOHAB), NOAA and our partners have investigated factors that regulate the dynamics of HABs and the mechanisms by which they cause harm. Allow me to highlight some of our successes; NOAA has produced coupled bio-physical models that form a critical base for building HAB forecasts; NOAA has successfully applied technology from remote sensing and medical science to the detection and tracking of algal species and their toxins to help states target their monitoring and management efforts; and, NOAA has developed a national database where research findings are shared and made available to scientists and the public. Through the Monitoring and Event Response for Harmful Algal Blooms program (MERHAB), NOAA puts these new tools within reach for the routine monitoring efforts of States and Tribes in several U.S. coastal regions. MERHAB partners are testing and refining these technologies to provide a reliable, cost-effective system for detection and monitoring harmful algal species and their toxins. Through the Coastal Ocean Program, we have expanded efforts to monitor, model, and predict the impacts of hypoxic events on Gulf resources. The following sections highlight accomplishments in the five areas of statutory authority.

***HAB Research and Assessment Activities in NOAA Laboratories*** - NOAA's laboratories have focused on two key impediments to effective HAB management: 1) the lack of sensitive, toxin-specific assays and toxin standards for research and field application, and 2) an understanding of how the physiology of these organisms affect toxin movement through the food web. Results from these laboratories have led to developments that are now aiding coastal scientists and managers to collect critical, and timely information on the occurrence of HABs. Recent accomplishments include:

- Identification of the chemical structures of some key HAB toxins
- Development of toxin- and species-specific detection probes and assays that will significantly enhance HAB research, monitoring, and management
- Increased understanding of bio-physical processes controlling red tides that originate in the Gulf of Mexico, but may travel as far north as North Carolina via the Gulf Stream
- Added insight into physiology and environmental toxicity of *Pfiesteria* species.

***Ecology and Oceanography of Harmful Algal Blooms (ECOHAB)*** - Administered by NOS's Coastal Ocean Program, ECOHAB is run cooperatively with the National Science Foundation, U.S. Environmental Protection Agency, National Aeronautics and Space Administration, and the Office of Naval Research. ECOHAB seeks to understand the causes and dynamics of HABs; develop forecasts of HAB growth, movement, landfall, and toxicity; and produce new detection methodologies for HABs and their toxins. Projects selected for support must successfully compete in a peer-review process that ensures high-level scientific merit. This program has served as an international model

that has fostered similar programs around the world. Some highlights of ECOHAB's large-scale regional studies include:

- The Florida project is testing the hypothesis that iron from Saharan dust clouds may stimulate red tides in the Gulf of Mexico. Using satellite sensors, which can detect dust clouds, it may be possible to forecast these offshore red tide blooms.
- Studies of the Long Island Brown Tide, which now impacts New York, New Jersey, Delaware, and Maryland, have uncovered a correlation between this organism's unique physiology, its ecology, and a suite of environmental conditions that precipitate these blooms.
- A large regional study in Maryland, and many targeted studies, have focused on understanding the distribution, toxicity, life cycle, and environmental factors that control outbreaks of *Pfiesteria* and co-occurring, toxic, dinoflagellates.
- The Gulf of Maine project is developing a biophysical model for simulating and ultimately forecasting the distribution of species responsible for Paralytic Shellfish Poisoning in the Gulf of Maine. This project is near completion.
- Last year a study to investigate the physical and biological causes of nuisance macroalgal blooms was initiated in coastal Maui so that predictive models and management strategies can be developed.
- A large-scale regional effort began in the Pacific Northwest last year to develop a model of bloom formation and movement. This model is based on physical and biological factors controlling blooms of domoic acid producing organisms that cause amnesic shellfish poisoning.

***Monitoring and Event Response for Harmful Algal Blooms (MERHAB)*** - Also administered by NOS's Coastal Ocean Program, MERHAB forges working partnerships between leading regional government, public, and private entities that transfer recent advances in HAB science and technology into existing State and Tribal coastal monitoring programs. Projects selected for support successfully compete in a peer-review process that ensures high-level scientific merit and resource management relevance. Highlights of program accomplishments to date include:

- Support for regional HAB mitigation efforts include developing early warning systems along the Olympic coast where closures of Dungeness crab and razor clam harvesting are increasingly common; providing rapid, cost effective, and highly sensitive toxin detection methods to help reduce public health risks of coastal Native Americans from California to Alaska; and incorporating continuous, real-time monitoring of coastal habitats into Chesapeake Bay and Florida state HAB monitoring programs.
- Similar, recently-initiated efforts seek to augment state HAB monitoring and response capabilities in the Great Lakes, Eastern Gulf of Mexico and Gulf of Maine; and are currently testing the feasibility of new detection methods in coastal waters of Texas, Florida, and Virginia. These efforts are crucial to coastal ocean observation and HAB forecasting efforts.
- New techniques have enhanced HAB bioassay laboratories in Florida and North Carolina and improved access to expertise, laboratory facilities, sampling

platforms, and remote sensing imagery by local and Federal agencies responding to unexpected HAB-related events, such as die-offs of sea lions along the California coast, manatee deaths along the Florida coast, and whale deaths on Georges Bank;
- MERHAB investments in HAB impacted regions around our coast are creating a community of scientists and managers who have benefitted from new monitoring technologies and who will also benefit from integrated coastal ocean observation and data management systems.

***Research on HAB Prevention, Control, and Mitigation (PCM)*** – While research on HAB prevention and control has received only limited attention to date, some advancements have been made in: using clay to scavenge HAB organisms from the water column; identifying natural *Pfiesteria* predators; using viral agents for suppressing brown tide organisms; and using bacterial agents that may ultimately prove useful in controlling red tide organisms. While research on prevention and control has been limited, there have been significant ECOHAB and MERHAB investments which have allowed the development of tools that help mitigate HAB impacts. For example:

- New remote sensing tools are used to track Florida Gulf Coast HAB movements and provide the first-ever HAB forecasts for Florida resource managers. Plans have been developed to operationally provide forecast bulletins to managers. These tools are also being tested in Texas waters and off the West Coast.
- Biophysical models for the Gulf of Maine and the west Florida Shelf will enhance the ability to forecast HAB movement and landfall, providing early warnings.
- New analytical capabilities for rapid and inexpensive detection of algae and toxins have been developed. These include molecular probes for *Pfiesteria*, moored detectors for species responsible for Amnesic Shellfish Poisoning, optical detectors on moorings and autonomous gliders to detect and map the Florida red tide species.

***Hypoxia Research and Monitoring*** - In the 1990s, through support from NOS's Coastal Ocean Program, the scientific community documented the distribution and dynamics of the hypoxic zone over the Louisiana continental shelf. Model simulations and research studies produced considerable evidence that nutrient loading from the Mississippi and Atchafalaya River system is the dominant factor in driving hypoxia. The duration and extent of hypoxic events in the region exceeds historical conditions. The efforts of the Coastal Ocean Program provided the primary data and information for six technical reports and the Integrated Assessment of the causes and consequences of Gulf hypoxia, as well as the Action Plan produced under Sections 604(a) and 604 (b) of this statute.

The Coastal Ocean Program (COP) initiated a new research program in the Gulf of Mexico in 2000 to improve our understanding of, and ability to forecast, the effects of changes in ocean conditions and river nutrient loads on hypoxia and its effects on Gulf productivity. These studies target high priority research areas outlined in the Integrated Assessment and the Action Plan and are a key component of the Task Force's monitoring, modeling, and research strategy supporting the Action Plan. On-going

investigations include: developing models for predicting the formation of hypoxia given varying levels of nutrient inputs and physical forcing, including varying freshwater inputs; increasing the understanding and quantifying the biological, chemical and physical drivers of hypoxia; documenting the distribution and dynamics of the hypoxic zone; and examining the effects of the hypoxic zone on ecologically and economically important species. Projects selected for support by this program successfully compete in a peer-review process that ensures high-level scientific merit.

COP investigations have documented the zone over the Louisiana continental shelf with seasonally depleted oxygen levels since 1990. In the summer of 2002, the largest hypoxic zone ever recorded was measured at 22,000 km, an area larger than the size of Massachusetts. Recent COP studies have used past and potential future nutrient and freshwater inputs to obtain a historical perspective for this hypoxic region, and to issue the first ever forecast for the size of the hypoxic zone for the summer of 2003. Studies have also documented the fine-scale distributions of fish and shrimp with respect to hypoxia and are examining the effects of hypoxia on the ecosystem.

While the focus to date has been on hypoxic events along the Louisiana and Texas continental shelf, we have recently supported the development of a science plan for addressing hypoxia issues nationally. We have begun discussions with the academic community and other Federal agencies on implementation of a potential joint national program.

Concluding Remarks

The impacts of harmful algal blooms and hypoxia on coastal and Great Lakes ecosystems, resources, and economies are as great now as they were in 1998. Reauthorization and revision of the Harmful Algal Bloom and Hypoxia Research and Control Act is timely and warranted.

Mr. Chairman, this concludes my testimony. I would be pleased to answer any questions that you or other Members may have.